http://vho.nasa.gov/mission/wind/sms/wind_stics_lv2_release_notes_revB.txt

WIND/STICS Level 2 Data Release Notes

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Introduction

The Suprathermal Ion Composition Spectrometer (STICS) is a time of flight (TOF) plasma mass spectrometer. It uses an electrostatic analyzer to admit ions of a particular energy per charge (E/Q) into the TOF chamber. The E/Q voltage is stepped through 30 values, sitting at each value for approximately 24 sec., to measure ions over the full E/Q range of 6 - 200 keV/e. Ions then pass through a carbon foil and TOF chamber, before finally impacting on a solid state detector for energy measurement. STICS combines these three measurements of E/Q, TOF and residual energy, producing PHA words. This triple-coincidence technique greatly improves the signal to noise ratio in the data.

Method

PHA words from an entire day of measurements are accumulated then assigned to individual ions via an inversion method, which preserves the statistical properties of the measurements. After assignment, these counts vs. E/Q curves are transformed to distrubution function, phase space density as a function of velocity. Additionally, a quality filter is applied is to discard curves which do not have at least 3 points.

This analysis procedure is applied to a wide range of ions. Currently, only
protons and alpha particle distribution functions are released at the production level.

Instrumental effects

STICS does not apply a post-acceleration voltage to boost ion energy, so low mass and low energy ions do not have enough kinetic energy at the lower E/Q steps to trigger the solid state detector and produce a full, triple-coincidence measurement. This produces a sharp cutoff a lower velocities in the phase space density curve. This cutoff is also mass dependent, making it slightly different for protons and alphas particles. Heavier and/or higher charge state ions have considerably more kinetic energy for a given E/Q and thus can be measured.

STICS measures ions from an energy regime significantly above the normal solar wind. The flux of particles in this range will vary considerably with solar wind density, velocity and thermal velocity, as well as due to many other solar phenomena (e.g. CMEs). Lower

statistics of suprathermal populations frequently result in distribution functions that are not continous in v and timeperiods where there are insufficient counts from which to assemble quality distribution functions.

Data description

The wtlv2_deliv_distfunc_*.dat files contain phase space density distribution functions, A(v), for two ions, H+ and He2+. There are 30 values for A(v), corresponding to each E/Q step, for each of the two ions at each timestep. The data is subcommutated in ion so that all 30 (v, A) pairs are tabulated for H+, then all 30 (v, A) pairs for He2+ for a single time step. Subsequent timesteps follow the same pattern.

The filenames includes the date of the observations, in yyyymmdd format. For example, wtlv2_deliv_distfunc_20050801.dat is data for 01 Aug 2005.

Values which cannot be properly calculated or do not meet quality standards are filled with value of -1.0.

The columns in these files are as follows:

year -- calendar year

doyfr -- day of year fraction, e.g. doy 200.5 in 2005 is noon on 19Jul2005.

ion -- the ion for which the phase space density is tabulated

E/q -- energy per charge (keV/e). Provided for convenience only.

v -- the center of the velocity bin in km/s, calculated from E/Q and the M/Q of the ion.

A -- the phase space density, in arbitrary units, at the corresponding velocity bin

ErrA -- The relative error in the phase space density value, i.e. ErrA = .10 indicates a 10% error on the corresponding A value.

Calibration Notes

STICS was calibrated prior to launch with ion accelerators at both NASA GSFC and at the University of Bern in Switzerland (facility details can be found in Ghielmetti et al.,1983). Goddard tests included measuring the instrument response to H+, He+, C+, C2+, N+, N2+, O2+, and Ne2+. Beam measurements at Bern included H+, He+, C+, O+, Ne+, Ne3+, Ar4+, and Kr5+. Post-launch, it was cross calibrated with helium solar wind data

from WIND-MASS and WIND-EPACT-STEP. The Time-of-Flight efficiencies were compared with those on Geotail EPIC-STICS (heritage) and Ulysses SWICS.

Further SMS calibration details can be found in Chotoo, 1998.

Contacts

For science questions relating to STICS, contact Sue Lepri (slepri@umich.edu), SMS Instrument Scientist. For data and instrument operations questions, contact Jim Raines (jraines@umich.edu), SMS Instrument Engineer.

References

Gloeckler, et. al., "The Solar Wind and Suprathermal Ion Composition Investigation on the WIND Spacecraft", Space Science Reviews, 71, p79-124, 1995.

Ghielmetti, A. G., et al., Calibration System for Satellite and Rocket-borne Ion Mass Spectrometers in the Energy Range from 5 eV/charge to 100keV/charge, Rev. Sci. Instr., 54(5), 425-436, 1983.

Chotoo, K., Measurements of H+, He2+, He+ in Corotating Interaction Regions at 1 AU, PhD Thesis, Univ. of Maryland, 1998.

Revision History

Rev	Date	Author(s)	Description
	04Dec2007	JMR/STL	Initial writing.
A	18Dec2007	STL	Addition of calibration notes
B	14Feb2008	STL	Clarified low E/Q cutoff.